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## RESEARCH NOTE LS-31

LAKE STATES FOREST EXPERIMENT STATION • U. S. DEPARTMENT OF AGRICULTURE

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## Nursery Selection Affects Survival and Growth of Birch

Numerous studies have shown that size of the planting stock affects survival and growth of many conifers. Much less is known about deciduous species, but Engstrom and Stoeckeler<sup>1</sup> reported better survival of 12 different species with increasing size of the seedlings. The only study of birch showed that first-year survival and height growth of paper birch and yellow birch were directly related to the initial size of the nursery stock.<sup>2</sup> However, the effect is not restricted to the first year after planting. Recent observations of two other birch species demonstrated that trees grown from the largest nursery stock had better survival than those originating from smaller stock after 9 years in the field. Furthermore, the plants originally classified as large, medium, and small still maintained their relative positions with respect to both height and diameter of the trees.

The birches studied, *Betula pubescens* Ehrh. and *B. pendula* Roth,<sup>3</sup> are European white birches; both lots were of Finnish origin. These trees are growing in a small arboretum on the Argonne Experimental Forest in northern Wisconsin. The seedlings were raised in the Hugo Sauer Nursery and planted in the arboretum as

3-0 stock in the spring of 1954 at a 6.6 by 6.6-foot spacing. At the time of lifting, the seedlings were sorted into lots of large, medium, and small plants. Fifty seedlings of each grade of *B. pubescens* and 100 large, 50 medium, and 50 small seedlings of *B. pendula* were planted.<sup>4</sup>

When the plots were checked for survival during the summer of 1962, a pronounced gradient in the size of the trees was observed within each plot. To check whether this gradient coincided with the original size of the plants, the height and diameter of each of the surviving trees were measured in September 1962. The data were kept separate for the original subplots of large, medium, and small plants of each species.

The survival for both species was highest for the large grade, less for the medium, and poorest for the small grade as shown below.

Species and grade	Survival (percent)	Mean height (feet)	Mean d.b.h. (inches)
<i>Betula pubescens</i>			
Large	98.0	12.9	2.14
Medium	90.0	8.7	1.05
Small	68.0	6.5	.55
Average	85.3	9.7	1.33
<i>Betula pendula</i>			
Large	83.0	12.5	1.74
Medium	42.0	9.4	1.15
Small	38.0	7.5	.59
Average	61.5	11.2	1.46

<sup>1</sup> Engstrom, H. E., and Stoeckeler, J. H. *Nursery practice for trees and shrubs suitable for planting on the prairie-plains*. U.S. Dept. Agr., Misc. Pub. 434, 159 pp., illus. 1941.

<sup>2</sup> Stoeckeler, J. H., and Jones, G. W. *Forest nursery practice in the Lake States*, U.S. Dept. Agr., Agr. Handb. 110, 123 pp., illus. 1957.

<sup>3</sup> This species is also known as *B. verrucosa* Ehrh. in Europe.

<sup>4</sup> The nursery work as well as the outplanting in the arboretum was supervised by J. H. Stoeckeler of the Station staff.

The large-grade and medium-grade trees of *B. pubescens* survived considerably better than those of the small grade. On the average, the large-grade trees were 4.2 feet taller than the medium-grade trees, which again were 2.2 feet taller than the small-grade trees. A similar pattern is apparent in the diameter of the trees. The mean d.b.h. of the large grade was 1.09 inches greater than that of the medium grade, which exceeded the small grade by 0.50 inch. All differences are statistically significant.

The large-grade *B. pendula* had about twice as high survival percentage as the medium and small grade. The medium-grade trees survived only slightly better than the small-grade trees. The large-grade trees averaged 3.1 feet taller than those of the medium-grade, which in turn were 1.9 feet taller than the small-grade trees. The pattern is repeated in the diameter measurements: The difference between trees of the large and medium grades was 0.59 inch and between the medium and small grade was 0.56 inch. All differences in tree height and d.b.h. between the three grades are statistically significant.

When the species are compared, it is clear that *B. pubescens* survived better than *B. pendula*. It also had the tallest and thickest trees in the large grade; but in the other two grades, it was exceeded by the *B. pendula*. The latter species had the greatest mean height and diameter when all three grades are considered together as one plot. This is due partly to the comparatively larger trees in the medium and small grades but also to a greater number of trees of the large grade. Although this subplot had poorer survival than the corresponding subplot in *B. pubescens*, it originally contained twice as many plants, thus raising the mean values for the *B. pendula*.

In birches the use of small nursery stock should therefore be discouraged since it not only may lead to a poor stocking level but in addition has an adverse effect on the growth rate of the stand. These results further suggest that it may be feasible to identify potential superior birch trees at an early age by selecting the most vigorous seedlings in the nursery beds.

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